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ABSTRACT: The California wild rice *(Zizania aquatica)* industry considers red-winged blackbirds *(Agelaius phoeniceus)* their most important pest problem. Farmers often have asked if crop-damaging blackbirds can be killed by mixing dry Portland cement or plaster-of-Paris with grain bait. We conducted a series of tests to determine the effect of cement or plaster mixed with wild rice fed to captive redwings and to determine feeding preferences of redwings for wild rice in relation to other grains. Birds would not eat cement- or plaster-treated rice when untreated rice was available and no mortality occurred when birds were offered only treated rice over a four-day period. Thus, treating grain with cement or plaster will not kill redwings but cement or plaster might serve as useful bird repellents for seed grain. Proso millet was strongly preferred over wild rice by redwings, indicating millet would be an excellent candidate as a lure crop and as a bait for trapping or for delivering a chemical. Sunflower would perhaps not be a preferred bait or lure crop in wild rice areas and cracked corn would not be a preferred bait.

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INTRODUCTION

The California wild rice industry annually spends over $30/acre on blackbird control and considers blackbirds, primarily red-winged blackbirds, their most important pest problem. Current control technologies, mainly shotgun shooting and harassment by airplane, are considered inadequate (Marcum 1993). Economic returns (benefits minus costs) from the use of these control techniques are largely unknown (Gorenzel et al. 1986).

During a visit of wild rice growing areas in Sutler, Shasta, and Modoc Counties, California in August 1993, we noted some growers were attempting to capture blackbirds in decoy traps baited with wild rice "chits" (broken and partially developed grains removed during processing for packaging). Growers also asked if it would be feasible to reduce blackbird populations by treating wild rice chits with some type of toxicant or sterilant to be placed as bait along field levies. One common suggestion was that blackbirds might be killed by consuming dry Portland cement or plaster-of-Paris mixed with chits placed along levies. The idea was that the cement or plaster would disrupt the digestive systems of birds ingesting the mixture. We explained to the growers that basic information on feeding preferences of blackbirds for wild rice in relation to other grains is needed for any future management programs using bait to trap, poison, or sterilize birds or for lure crops to divert birds from the ripening rice. Furthermore, any toxicant or sterilant would have to be tested and EPA-approved before operational use.

Because the use of cement or plaster mixed with grain frequently has been suggested as a means to kill birds and because little information is available on feeding preferences of blackbirds for wild rice in relation to other grains, we conducted a series of tests with captive birds. Our objectives were to determine: 1) the level of consumption and mortality for blackbirds fed wild rice treated with Portland cement or plaster-of-Paris, and 2) the feeding preferences of blackbirds given choices between wild rice and wild rice with cement or plaster; or between wild rice and sunflower, millet or cracked corn.

METHODS

Male red-winged blackbirds were captured in mist nets or decoy traps in Erie County, Ohio in September 1993. These birds were banded and placed in pairs in 1 x 1.5 x 0.5 m cages provided with water, grit and mixed bird seed (Woronecki et al. 1986). After the birds were acclimated to the cages for at least five days, the following tests, each using four or five cages (replicates) over four days (repeated measures), were conducted between September and December 1993.

Two-Choice Test: Rice vs. Rice/Cement—On Day 1 the birds were weighed at 0900 and two cups (each 0.1 L) were placed in each cage. One cup contained 25 g of cleaned wild rice chits and the other contained 25 g of cleaned wild rice chits mixed with 12.5 g of dry Portland cement. Each cup was secured on a 24 cm diameter pan to catch spillage. All other food, but not water and grit, was removed. For the next four days, the cups were removed each day at 0900 and replaced with fresh rice or rice/cement. The positions of the cups were randomized each day. The contents of the removed cups and spillage pans were weighed to determine consumption. Final consumption was adjusted for moisture gain or loss based on weight change of control cups of rice and rice/cement placed next to the cages. The birds were reweighed at the end of the test and observed in captivity for the following two weeks.

One-Choice Test: Rice/Cement—This test was identical to the two-choice test except that both cups contained the rice/cement mixture.

Two- and One-Choice Tests: Rice vs. Rice/Plaster—These tests were identical to the two- and one-choice tests with rice/cement except that a rice/plaster mixture was used.

Two-Choice Tests: Rice vs. Millet, Sunflower or Cracked Corn—These tests were identical to the rice vs. rice/cement test except that rice/cement was replaced by proso millet, oil-seed sunflower or cracked corn. The cracked corn was screened to obtain particles 4.0 to 4.3 mm in diameter.

Consumption of food was compared between treatments using analysis of variance with cages as blocks and days as repeated measures (Statistix 1992).

RESULTS

Two- and One-Choice Tests: Rice/Cement; Rice/Plaster—The birds virtually avoided eating rice mixed with Portland cement or plaster-of-Paris when provided untreated wild rice as an alternative ($P < 0.01$, Tables 1, 2). However, when provided only rice mixed with cement or plaster, mean daily consumption was not different ($P \geq 0.07$) than when untreated rice was available. This indicates the birds have a clear preference for untreated rice, but they will eat rice mixed with cement or plaster if other food is not available.

Birds showed no significant ($P \geq 0.68$) change in body mass during the two-choice tests with cement or plaster but there was a mean decline ($P < 0.01$) of 2.5 g (4.2% mass loss) during the one-choice test with only rice mixed with cement available (Table 3). There was no mortality of birds during any of the four, four-day tests with cement or plaster or in the two weeks following the tests.

Two-Choice Tests: Rice vs. Millet, Sunflower and Cracked Corn—The birds showed a clear preference ($P < 0.01$) for millet over wild rice, eating 5.5 times as much

Table 1. Mean consumption of cement-treated and untreated wild rice by red-winged blackbirds in two-choice and one-choice tests. Each test had four cages, each containing two male red-winged blackbirds, September-October 1993.

	Mean consumption (g) of wild rice/cage (two birds)/24 hrs			
	two-choice test			one-choice test
Day	Without cement	With cement	Total	With cement
1	19.2	0.7	19.9	15.9
2	21.6	0.8	22.4	20.4
3	20.0	1.2	21.2	18.5
4	19.3	0.7	20.0	18.9
$\bar{x}$	20.0[a]	0.9[a]	20.9[b]	18.5[b]

[a]Mean consumption of rice with and without cement was different ($P < 0.01$, $F = 81$, 1 and 3 df) in two-choice test.

[b]Total consumption of rice was not different ($P = 0.07$, $F = 4.8$, 1 and 6 df) between two-choice test (with untreated rice available) and one-choice test (with only cement-treated rice available).

Table 2. Mean consumption of plaster-treated and untreated wild rice by red-winged blackbirds in two-choice and one-choice tests. Each test had four cages, each containing two male red-winged blackbirds, November 1993.

	Mean consumption (g) of wild rice/cage (two birds)/24 hrs			
	two-choice test			one-choice test
Day	Without plaster	With plaster	Total	With plaster
1	21.6	0.2	21.8	14.8
2	22.1	0.0	22.1	25.0
3	20.5	1.9	22.4	28.3
4	20.4	2.1	22.5	27.8
$\bar{x}$	21.2[a]	1.0[a]	22.2[b]	24.0[b]

[a]Mean consumption of rice with and without plaster was different ($P < 0.01$, $F = 560$, 1 and 3 df) in two-choice test.

[b]Total consumption of rice was not different ($P = 0.45$, $F = 0.65$, 1 and 6 df) between two-choice test (with untreated rice available) and one-choice test (with only plaster-treated rice available).

Table 3. Change in body mass of red-winged blackbirds after four days of food preference testing with wild rice, September-December 1993.

Test	N	Body mass (g)				Paired diff. t-test	
		Day 1		Day 4 - Day 1			
		$\bar{x}$	SD	$\bar{x}$	SD	t	P
Rice vs. rice/cement (two-choice)	8	60.9	4.0	-0.5	3.0	-0.44	0.68
Rice/cement (one-choice)	8	59.6	5.1	-2.5	1.3	-5.29	<0.01
Rice vs. rice/plaster (two-choice)	8	70.9	5.2	-0.5	4.7	-0.34	0.75
Rice/plaster (one-choice)	8	68.6	6.4	0.3	3.1	0.28	0.79
Rice vs. millet (two-choice)	10	64.8	6.7	-1.9	2.6	-2.27	0.05
Rice vs. sunflower (two-choice)	10	59.7	4.3	0.4	1.7	0.64	0.53
Rice vs. cracked corn (two-choice)	10	64.0	5.4	-1.5	2.0	-2.39	0.04

Table 4. Mean consumption by red-winged blackbirds of proso millet, cracked corn and sunflowers presented in two-choice tests with wild rice, October-December 1993. Each test had five cages, each containing two male red-winged blackbirds.

Day	Mean consumption (g)/cage (two birds)/24 hours					
	two-choice test		two-choice test		two-choice test	
	Wild rice	Proso millet	Wild rice	Cracked corn	Wild rice	Sun-flower
1	1.8	14.6	11.8	5.6	14.8	4.9
2	2.5	16.2	13.4	4.7	16.1	6.1
3	3.1	15.9	12.6	6.2	16.3	6.9
4	4.1	16.7	14.3	6.5	16.4	6.5
$\bar{x}$	2.9[a]	15.9[a]	13.0[b]	5.7[b]	15.9[c]	6.1[c]

[a]Mean consumption of millet was greater ($P < 0.01$, $F = 51.9$, 1 and 4 df) than of rice.
[b]Mean consumption of rice and corn was not different ($P = 0.09$, $F = 4.92$, 1 and 4 df).
[c]Mean consumption of rice and sunflower was not different ($P = 0.15$, $F = 3.14$, 1 and 4 df).

millet as wild rice over the four-day test (Table 4). In contrast, birds showed indications of preferring wild rice to sunflower and cracked corn, although the differences in consumption were not significant (P .>. 0.09). Birds had a mean decrease (P <_ 0.05) in body mass of 1.5 to 1.9 g (2.2 to 2.9% loss) during the rice-millet and rice-cracked corn tests but no change (P = 0.64) during the rice-sunflower test (Table 3). There was no mortality during or after these tests.

DISCUSSION

Treating rice seed or other grain with Portland cement or plaster-of-Paris to use as a bait to kill blackbirds is likely to be totally ineffective. First, birds would not eat cement- or plaster-treated rice when untreated rice was available. Second, no mortality occurred even when the birds were offered only cement- or plaster-treated rice over a four-day period. That red-winged blackbirds would not eat cement- or plaster-treated rice when other food was available indicates these or similar products might be useful as bird repellents for seed grains. Testing of this concept appears warranted.

Proso millet appears to be strongly preferred over wild rice by red-winged blackbirds, indicating millet would be an excellent candidate as a lure crop and as a bait for trapping or for delivering a chemical. Sunflower would perhaps not be a preferred bait or lure crop in wild rice areas and cracked corn would not be a preferred bait. Previous research (DeCapita and Cordes 1985, Kelley et al. 1987) has indicated millet is a highly preferred food for brown-headed cowbirds *(Molothrus ater)* compared to sunflower.

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